USING A CAUSAL SMOOTHING TO IMPROVE THE PERFORMANCE OF AN ON-LINE NEURAL NETWORK GLUCOSE PREDICTION ALGORITHM

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Aims: This work evaluates a spline-based smoothing method applied to the output of a glucose predictor.
Methods: Our on-line prediction algorithm is based on a neural network model (NNM). We trained/validated the NNM with a prediction horizon of 30 minutes using 39/54 profiles of patients monitored with the Guardian® Real-Time continuous glucose monitoring system. The NNM output is smoothed by fitting a causal cubic spline. The assessment parameters are the error (RMSE), mean delay (MD) and the high-frequency noise (HFCrms). The HFCrms is the root-mean-square values of the high-frequency components isolated with a zero-delay non-causal filter. HFCrms is 2.90±1.37 (mg/dl) for the original profiles.
Results: Figure 1 depicts the original sensor profile, the NNM prediction without smoothing (P0), and with two different smoothness parameter values (P1-a:low-smoothing,P1-b:high-smoothing). Table 1 shows the evaluation parameters.

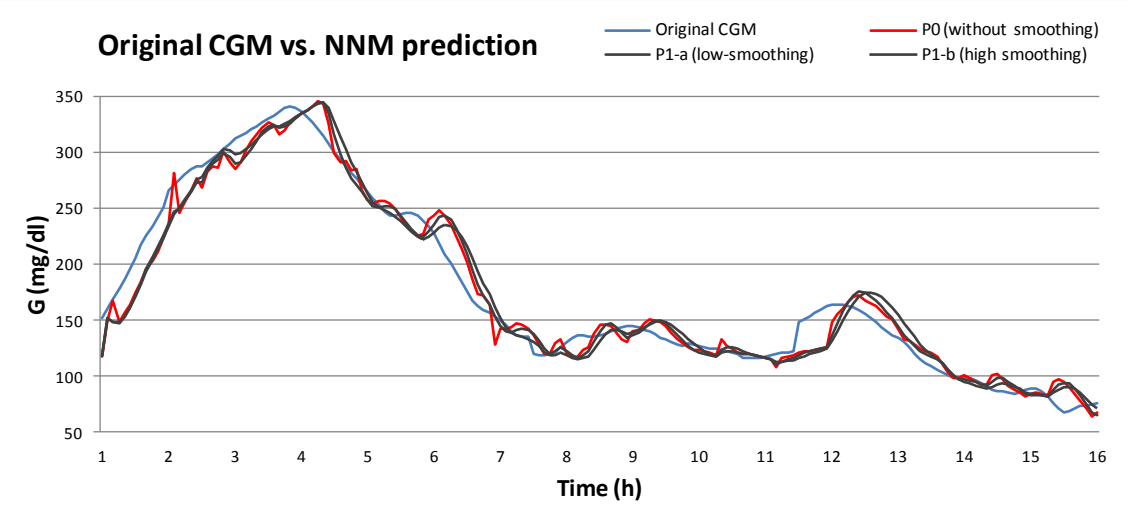

Figure 1

		P0	P1-a	P1-b
RMSE(mg/dl)		16.99±6.76	17.9±7.05	18.97±7.55
MD(minutes)	Upward	10.78±7.05	11.7±7.69	12.63±8.88
	Downward	7.86±5.28	8.22±5.48	9.69±6.16
HFCrms(mg/dl)		6.80±2.60	4.41±1.78	2.83±1.21

Table 1

Conclusions: Smoothing the NNM output provided a more stable (less noisy) prediction profile, what is useful to discard prediction artifacts; hence allowing safer corrective actions by the patient or by a closed-loop controller. Therefore, we suggest the HFCrms as an additional evaluation parameter to assess the performance of prediction algorithms.